

**REMARKS**

Entry of this amendment, reconsideration and withdrawal of all grounds of rejection in the Final Office Action, and allowance of the application are respectfully requested. Claims 1-7 remain pending in this application. Claim 2 has been amended. Favorable reconsideration is respectfully requested for the reasons indicated hereinbelow.

**Summary of the Rejections:**

(1) Claim 2 stands rejected under 35 U.S.C. §112, second paragraph as allegedly being indefinite.

(2) Claims 1, 2, 5 and 6 stand rejected under 35 U.S.C. §103(a) as allegedly being obvious over Uno et al. (JP 6-342052, hereafter “Uno”) in view of Radic et al. (*25 GHz Interleaved Bidirectional Transmission Over Non-Zero Dispersion Shifted Fiber*, by S. Radic, S. Chandrasekhar, A. Srivastava, H. Kim, L. Nelson, S. Liang, K. Tai and N. Copner, hereafter “Radic”, March 17, 2001).

(3) Claims 3, 4 and 7 stand rejected under 35 U.S.C. §103(a) as allegedly being obvious over Uno in view of Radic as applied to claims 1, 2 and 6, and further in view of admitted prior art.

**Office Action Position:**

I. 35 U.S.C. §112:

It is alleged in the Office Action that the terminals in claim 2 are not in agreement with the terminals recited in claim 1.

II. 35 U.S.C. §103(a) rejection of claims 1, 2, 5 and 6:

It is alleged in the Office Action that claims 1, 2, 5 and 6 would have been obvious to a person of ordinary skill in the art over the disclosure of Uno in view of Radic.

According to the Office Action, Uno allegedly discloses:

(1) a first wavelength routing element (26) that combines wavelengths at a first and second terminal and outputs a combine signal at a third terminal;

(2) an optical fiber amplifier (10);

(3) a second wavelength routing element (36) that splits the amplified signal at the third terminal into the forward and reverse optical signals.

However, it is acknowledged in the Office Action that Uno fails to disclose or suggest the interleaving of forward and reverse propagating signals. Thus, the Office Action cites Radic as disclosing port interleavers, and it is alleged that the instant claims would have been obvious in view of the combination of references, because modifying Uno by substituting three port interleavers for the first and second wavelength routing

elements is beneficial to reduce four-wave mixing.

With regard to claim 2, the Office Action again uses Radic as motivation to modify the routing devices to be substituted with interleavers.

With regard to claim 5, it is alleged that an optical transmission inherently includes a first optical transmitter/receiver, and a second optical transmitter/receiver unit. Again, the Office Action relies on Radic to suggest use of interleavers to suppress coherent and incoherent crosstalk. Similar arguments are made to reject claim 6.

**III. 35 U.S.C. §103(a) rejection of claims 3, 4 and 7:**

It is alleged in the Office Action that there is an admission in the instant application that dispersion compensation modules located adjacent to the amplifier module are well known in the art ), Figs. 1 and 3 of prior art, and page 3, line 14 through page 5, line 10. Thus it I alleged that it would have been obvious to modify the apparatus taught by Uno and Radic by including a dispersion compensation module adjacent to the optical amplifier to reduce accumulated signal dispersion.

**Applicants' Traversal:**

**I. 35 U.S.C. §112:**

With regard to the rejection under 35 U.S.C. §112, second paragraph, claim 2 has been amended as suggested by the Examiner. Thus, Applicants respectfully submit that the amendment to claim 2 overcomes the 35 U.S.C. §112, 2<sup>nd</sup> paragraph rejection. Reconsideration and withdrawal of this ground of rejection are respectfully requested.

**II and III: 35 U.S.C. §103(a):**

It is respectfully submitted that none of the instant claims would have been obvious to a person of ordinary skill in the art in view of the combination of Uno and Radic, and/or Uno and Radic in view of alleged Admitted Prior Art.

Applicants have amended base claims 1 and 5 to recite that the instant invention has a single erbium doped fiber amplifier (as shown, for example in Fig. 4 EFDA 630) and Fig. 6, while the interleaved bi-directional loop shown in Radic has a total of four optical amplifiers  $OA_{W1}$ ,  $OA_{W2}$ ,  $OA_{E1}$ , and  $OA_{E2}$ . As noted in the instant specification on page 8, lines 10-15, a drawback of conventional amplifiers is that there is a requirement of duplicated elements, particularly, optical amplifiers.

The alleged combination of teachings of Uno and Radic still shows a plurality of amplifier, one being required for each line.

Thus claim 1 has been amended to recite a single optical amplifier unit having a single optical amplifier for amplifying only the interleaved optical signal received from the third terminal of the first interleaver” to clarify that there is only a single optical amplifier 630 and it only amplifies the output of the first interleaver 620 of the optical unit.

Claim 5 has been amended to recite that “an optical amplifier device **comprising a single amplifier** arranged on the optical fiber and adapted to interleave the channels of the forward and reverse optical signals, bi-directionally received via the optical fiber, in accordance with the wavelengths of the channels, to amplify **only a single** interleaved optical signal generated in accordance with the interleaving operation... .”

It is respectfully submitted that the combination of Radic and Uno fails to disclose or suggest limitation of the requirement of optical amplifiers used with Interleaving units.

For example, Uno is completely silent in this regard. Radic, on the other hand, discloses on the first page section 3 (Results and Decision) that interleaved bi-directional transmission generates large levels of coherent and incoherent cross talk at amplification nodes, which he illustrates at Fig. 2. Radic confirms this problem with bi-directional loops on page 2 when he states that “the loop architecture *necessarily* introduces an excessive amount of loss that *needs to be overcome by an in-line amplifier ...*” (emphasis in Italics and boldface added). Radic uses four in-line optical amplifiers, OA’s East 1 and 2, and OA’s West 1 and 2 for the loop.

Accordingly, it is respectfully submitted that the combination of Uno and Radic would have failed to disclose, suggest, or motivate a person of ordinary skill in the art at the time of invention such that a reduction in the number of optical amplifiers used in an optical amplifier unit having interleavers would have been obvious from the teachings of the combination of references.

Finally, Applicants respectfully submit that Uno discloses that two different wavelength bands are allocated for forward and reverse directions so as to perform a bi-directional optical amplification.

Applicants respectfully refer to paragraph [0010] of Uno which states that:

in order to perform a bi-directional optical amplification in the subject invention, a feedback loop can not be created according to a remaining reflectance ratio for each signal wavelength, by allocating two different wavelength bands for forward and reverse directions so as to perform a bi-directional optical amplification. An optical multiplexing unit is composed of an optical circulator or an optical wavelength compound/branch, so that bi-directional optical signals having different wavelength bands are respectively incident into an optical amplifier unit that is composed of one

optical amplifier.

The optical wavelength multiplexing/de-multiplexing units 26, 36 shown in Fig. 8 of Uno carry out a function of combining or dividing two wavelength bands different from each other. Uno further states at paragraph [0040] that the “optical wavelength of multiplexing/de-multiplexing units 26,36 are the same characteristic as the second embodiment according to the subject invention.”

Furthermore, paragraph [0030] states that “this optical wavelength multiplexing/de-multiplexing units 26, 36 are a kind of wavelength filter, and they lead a certain wavelength to a predetermined position. The optical multiplexing/de-multiplexing units 26, 36 are a kind of wavelength filter, and they lead a certain wavelength to a predetermined direction. The optical multiplexing-de-multiplexing unit 26 leads a wavelength of  $1.54\mu m$  or more to an optical filter 23. ”

Consequently, the device shown in Fig. 8 bi-directionally amplifies forward and reverse propagating signals having two different wavelength bands. Accordingly, in the construction shown in Fig. 8 of Uno, if the wavelength multiplexing/de-multiplexing units are simply replaced with interleavers, about half of the channels of the forward and reverse propagating signals having the different wavelength bands would disappear. The reason for half of the different wavelength bands disappearing is because an interleaver separates a wavelength band, as shown in Fig. 5 of the present invention, into two wavelength bands allocated for forward and reverse directions. Accordingly, Applicants respectfully submit that it is not possible that the combination of Uno, Radic, and the alleged Admitted prior art would have made any of the instant claims obvious to an artisan at the time of

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invention. Reconsideration and withdrawal of all grounds of rejection under 35 U.S.C. §103(a) are respectfully requested in view of all of the above arguments.

If any issues remain which may best be resolved through a telephone communication, the Examiner is requested to kindly contact the undersigned at the telephone number listed below. If there are any fees due and owing, please charge Deposit Account No. 502-470.

Respectfully submitted,

CHA & REITER

Date: December 22, 2003

By:

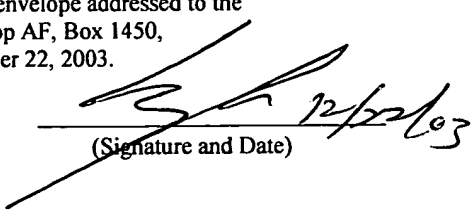
  
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